

CEMENT MILL SECTION of Concrete

The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of portland cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

Volume 41

March, 1933

Number 3

CONTENTS

New Clinker Coolers Save Kiln Fuel and Improve Grindability—(Illus.)	33
Details of a proved installation in a middle western plant; experiments, main features; chamber linings, driving mechanism.	
Study of Binary System $\text{CaO}\cdot\text{B}_2\text{O}_3$—(Illus.)	41
Elmer T. Carlson, in abstract, tells of investigation with ultimate object of determining effect of boric oxide addition to calcium silicates.	
New Books and Pamphlets	42
Editorial	43
Shaping Legislation on Unemployment Reserves. Paying for Modernization Without Getting It. The Hi's and Ho's of the Cement Industry.	
Overcoming Difficulties of Burning High-Limed Cement—(Illus.)	44
Japanese paper determines importance of proper selection of silica ratio and iron modulus.	
Determining Value of Limestones and Other Raw Materials	45
Edwin C. Eckel deals with question of proper raw material valuation as factor in fixing tax returns and in industrial financing.	
Personals	46
Separating the Ingredients of Commercial Cement-Trass Mixture	46
Details of simple method of procedure.	
Cement Statistics for January—(Illus.)	47
Mill Equipment—(Illus.)	47
With the Manufacturers of Equipment	48

Copyright, 1933, by Concrete Publishing Co.

INDEX TO ADVERTISEMENTS

Allis-Chalmers Co.	34	Fuller Co.	—
Engineering & Designing	30	General Motors Truck Co.	Back Cover



Allis-Chalmers Compeb mill with air separation in a plant of Missouri Portland Cement Co.



MODERN cement making machinery has developed so rapidly during the last few years that equipment installed as late as five or six years ago is to a large extent obsolete. The installation of new grinding machinery and other allied equipment will not only greatly lower the cost of production but also produce an improved quality of cement. The rehabilitation of existing plants would help the Cement Industry as a whole.

An outstanding example of reduced operating costs resulting directly from the installation of modern grinding machinery, may be found in the plant of the Missouri Portland Cement Company, St. Louis, which has been cited by the Robertson Committee for Industrial Rehabilitation as having effected a profit-paying plant modernization. Large modern grinding units have replaced obsolete mills. As a result production capacity has been materially increased, quality has been improved, and cost per barrel reduced more than twenty-six cents.

ALLIS-CHALMERS

— Allis-Chalmers Manufacturing Company, Milwaukee —

This advertisement is to help you get ready for better business

New Clinker Coolers Save Kiln Fuel and Improve Grindability

Easier Grinding Due to Rapid Cooling—Preheat Both Primary and Secondary Air for Combustion—Strength and Fineness Also Improved

A HOOK-UP between kiln and clinker cooler that recovers the heat from the clinker and returns the air, in a highly heated condition, for use in the kiln, has resulted in reducing the fuel consumption of eleven kilns in two plants of a midwestern cement manufacturing company.

Long a Subject of Experiments

Utilization of the heat given off by cement clinker during the cooling process has long been a problem with which cement men have experimented. Some years ago a plant in upstate New York operated a cylindrical clinker cooler which was water-jacketed. From the cooler the heated water was conducted to the boilers in the power plant, so that the clinker coolers, in fact, served as feed-water heaters for the boilers. This arrangement operated in an efficient manner. The clinker was cooled quite effectively, and the feed-water was duly heated. The objections to this method are, first, that in most plants there are other sources of waste heat which can be utilized in heating feed-water for boilers more conveniently and economically; and second, it is not the best practice to connect two operations which are so dissimilar as those of clinker cooling and feed-water heating.

Sometimes Used for Drying Coal

In several other plants the hot air from the clinker coolers is conducted to the rotary coal dryers and used for drying the coal. Where the distance from the coolers to the dryers is not too great, this practice has been successful. On the other hand, it will be shown later in this article that in the case of the clinker coolers installed in the two midwestern plants previously mentioned, the quantity of hot air recovered is considerably more than the volume needed for the kiln. In consequence, if the plant management were disposed to utilize part of the heated air for drying coal, the volume available would be ample for the purpose.

Preheaters for Air Entering Kiln

In many of the more modern mills which employ some form of rotary cooler, the cooler units are located at levels considerably below the discharge end of the kilns, so that the coolers may act as preheaters for the air entering the kiln. In general, the air for cooling the clinker is drawn in by the draft of the kiln, so that it passes from the cooler to the kiln in a preheated condition after coming in contact with the clinker.

The possibility of saving fuel may be realized from the fact that each barrel of clinker leaving a kiln at a temperature of 2,100 deg. F. carries out of the kiln nearly 200,000 B.t.u. This is equivalent to 16 lb. of 12,500-B.t.u. coal.

The new clinker coolers installed by the midwestern company are a type that was designed for the double purpose of accomplishing rapid cooling of the clinker, and recapturing the air heated in the cooling process and returning it to the combustion zone of the kiln with the secondary air. The units installed represent a number of years of experimental work.

The principles involved in the design of the cooler were borrowed from previous experience with open-hearth furnaces in which the hot waste gases were recovered and returned to the furnaces as a means of saving fuel.

Early Experiments

The earliest experiments were conducted with small models built to scale, as a practical effort toward the determination of the most effective means of recovering the highly heated air that absorbs the heat from the cooling clinker.

A Semi-Commercial Unit

The next step in the development of the Lee clinker cooler, by which name it is known, was the building of a small semi-commercial unit in a cement plant. It was capable of cooling about 90 bbl. of clinker in 24 hours. The enclosing chamber of this unit was built of fire brick, as a means of reducing loss of heat by radiation. The moving mechanism consisted essentially of a drag conveyor which moved slowly over a fixed grate. The air current used in the cooling process was introduced, under pressure, through a wind box underneath the fixed grate.

The experiments conducted by means of this semi-commercial plant demonstrated the soundness of the principles involved. The further fact was developed that the rapid cooling of the clinker had a most favorable effect on its grindability, a feature that will be discussed later in this article and in more detail.

More Heated Air Than Is Needed

These semi-commercial experiments also indicated a fact that was verified later in the full-size commercial installations, namely, that the volume of air passing through the cooler and recovered in a highly heated condition would be considerably more than the volume needed for the purpose of combustion in the kiln. It was demonstrated that where the cooler had a single chamber, so that all of the air was returned to the kiln, a proper balance between the requirements of the cooler and the requirements of the kiln could not be maintained. If enough air was forced through the cooler to bring the temperature of the clinker to a value approaching atmospheric temperature, the volume returned to the kiln was too great. If the volume of air conducted through the cooler was just enough to meet the secondary air require-

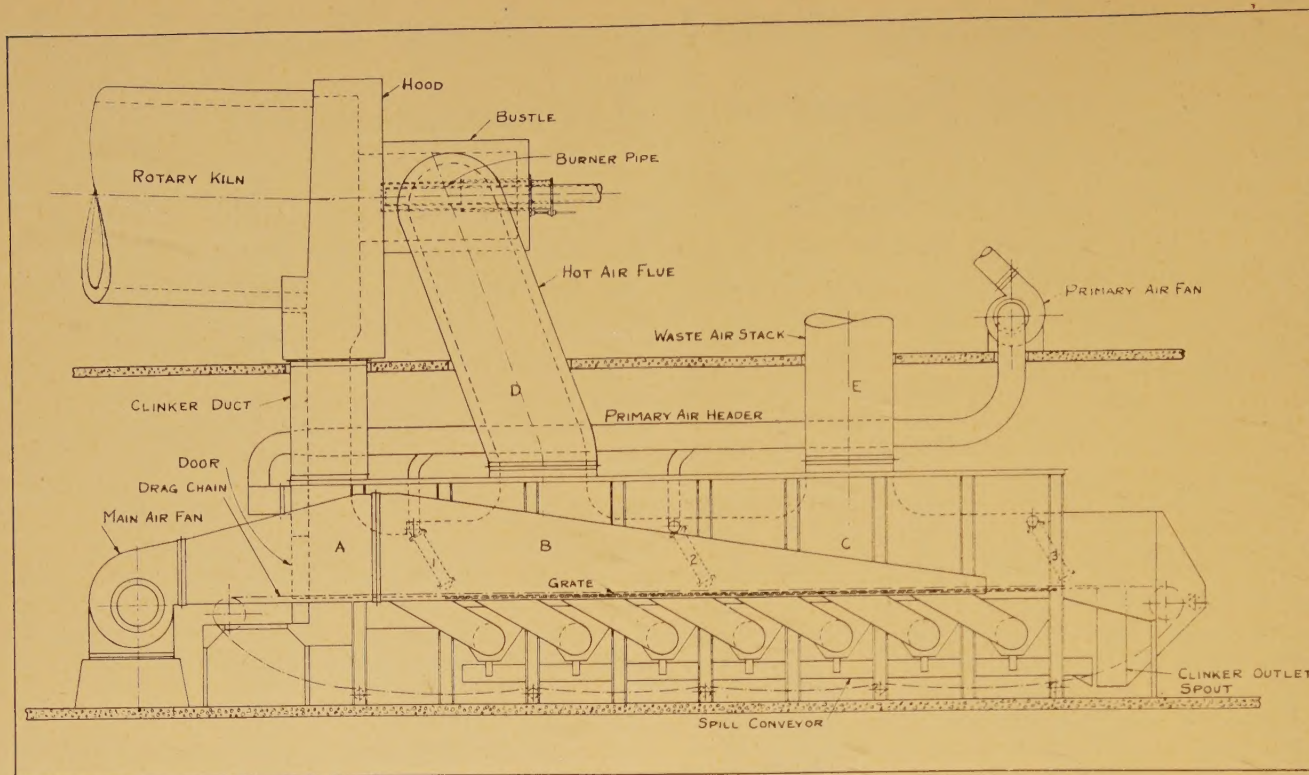


Figure 1. One of two most recent installations of Lee Process clinker cooler

ments of the kiln, the clinker was discharged from the cooler at a temperature much higher than was considered desirable.

The foregoing facts were taken into consideration in later development work, and the cooler as finally developed was divided into chambers. By making the necessary adjustments in the location of the divisions between chambers, it was found possible to divert to the kiln the air from the first, or hottest chamber, and either to waste the remaining air or utilize it for some other purpose.

The first commercial installation was made early in 1930 in the Detroit plant of the Peerless Cement Corp.

The space available for the unit installed was not sufficient to permit the use of more than one chamber in the cooler. The volume of air forced through the cooler grates, and which then entered the kiln through an annular opening around the fuel injection pipe, was just sufficient to meet the kiln requirements. In consequence, the clinker, when discharged from the cooler, had a temperature of about 900 deg. F.—much higher than the temperature desired.

Nevertheless, the Peerless installation, admittedly a step in the development of the cooler, handled an average of 1,600 bbl. of clinker in 24 hours, it supplied much use-

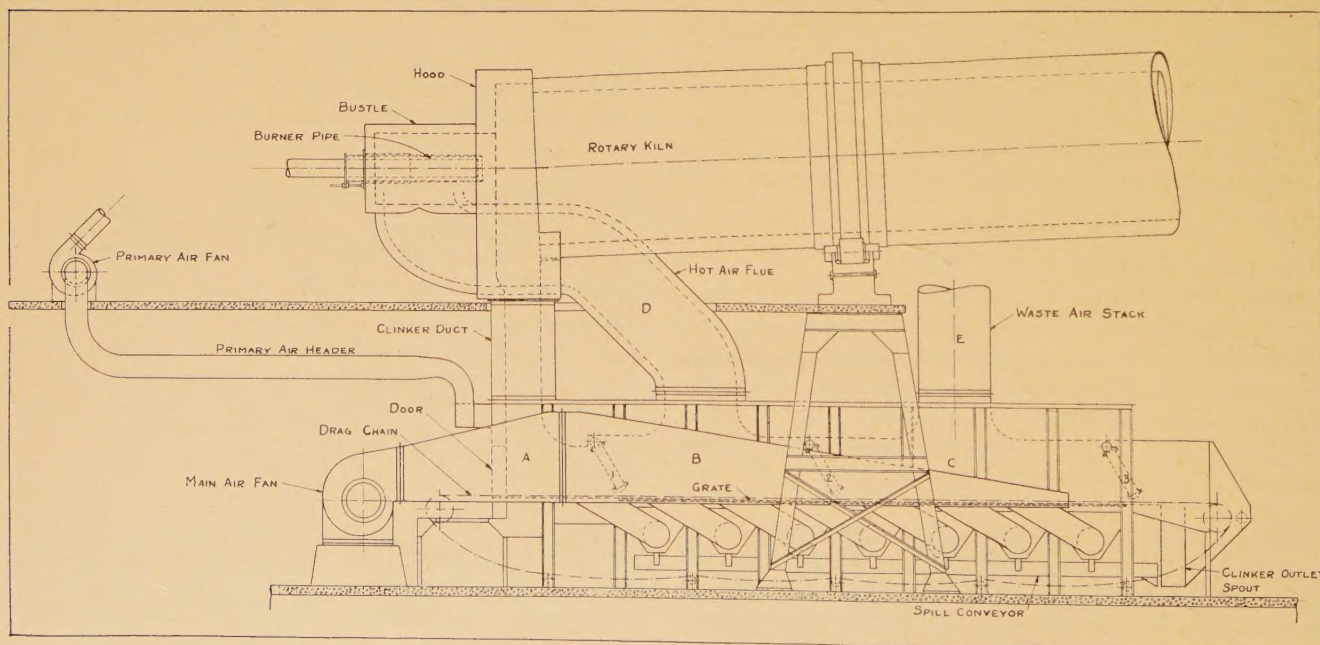


Figure 2. Same type of clinker cooler as Figure 1, but turned around and extended under discharge end of kiln

ful information, and it accomplished an actual saving of about 12 per cent of the kiln fuel.

The Installations

The first unit of the midwestern cement company's installations started operations in October, 1931. Its performance resulted in the installation of ten additional units.

Figure 1 shows the essential features of the units, and their arrangement with reference to the rotary kilns, as installed in one of the plants. Figure 2 shows the arrangement at the other plant, where the coolers are turned around and extend underneath the discharge end of the kilns. Either arrangement is satisfactory, the only essen-

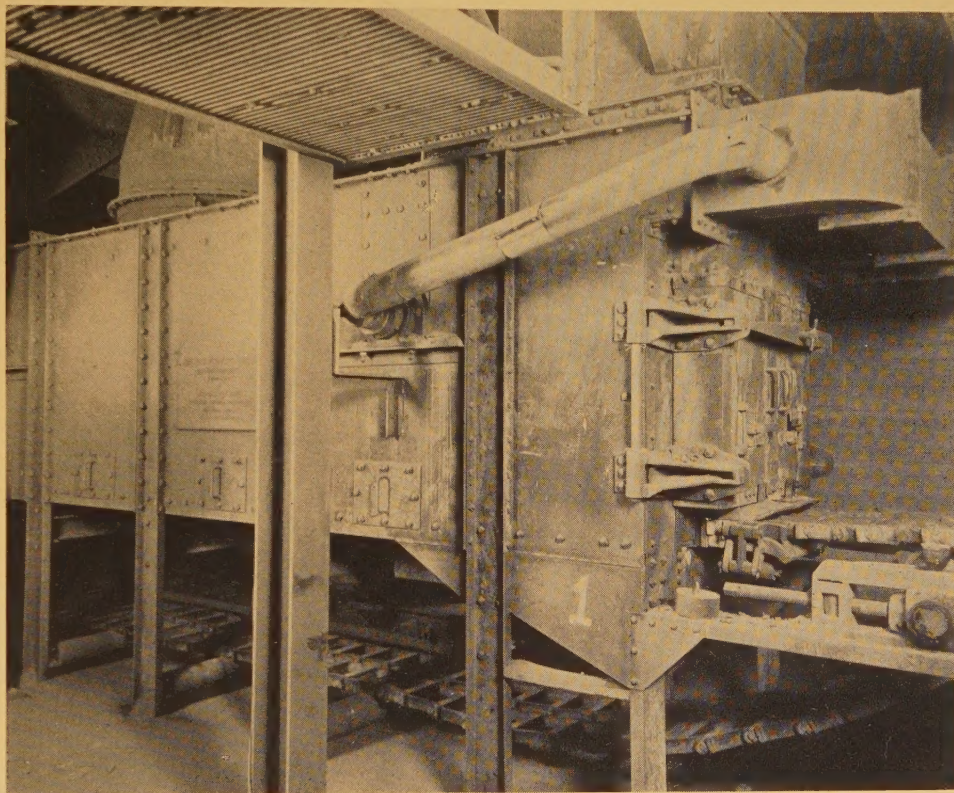
to put it another way, the position of gate *G* is located so that the volume of air recovered from chamber *B* is just enough to supply the requirements of the kiln.

Chamber *A* is simply the inlet chamber that receives the hot clinker as it falls from the kiln. Access to this chamber is obtained through a heavy and closely fitting swinging door shown at *D*.

Lining of the Chambers

Chambers *A* and *B* are heavily lined and walled with insulating units, to reduce heat loss by radiation. The floor of chamber *A*, in which there is no cooling grate, is lined with a layer of fire brick. The lower parts of the walls of this chamber, as well as the door at *D*, are faced

Figure 3. General view of feed end of Lee Process clinker cooler installation



tial difference being the length and shape of the flue that conducts the hot air from the first cooling chamber to the kiln.

Main Features of Cooler

Reference to Figures 1 and 2 shows that the cooler is divided into three compartments, or chambers, designated as *A*, *B* and *C*. The first and second chambers are separated by gate *F*, while gate *G* separates the second and third chambers, and gate *H* is at the outlet end of the cooler. As the drawings indicate, chamber *B* is the chamber from which the air flue *J* conducts the recovered hot air back to the kiln. The air from chamber *C*, which has a temperature of around 150 deg. F. and is considerably cooler than that coming from chamber *B*, is wasted through stacks.

It will be seen, from the foregoing, that the position of gate *G* determines the size of chamber *B*, and therefore it determines the volume of air returned to the kiln. Or,

with carborundum lining block as a means of resisting the abrasive action of the hot clinker falling from the kiln. The vertical walls of chamber *A* are lined with a 1-in. thickness of insulation and a 9-in. thickness of fire brick of first grade. The upper part of the chamber extends to within 1 in. of the bottom of the kiln hood. This space of 1 in., which is left to provide room for expansion and contraction, is sealed with asbestos rope and fire clay, to prevent leakage of air.

The walls and roof of chamber *B*, the initial cooling chamber, are built of a combination of fire brick and carborundum block. Heavy blocks of carborundum are set as the base for the side walls, adjacent to the clinker bed. Carborundum facing blocks then line the walls from the base block to the roof. Lining block of the same material face the opening in the top of chamber *B* which connects with the hot air flue *J*. The roof of chamber *B* consists of a flat arch of fire brick.

The main purpose of the carborundum block is that

of resisting the abrasive action of the clinker and clinker dust.

Chamber *C*, from which the heated air is wasted in this installation, is less heavily lined than the two preceding chambers, because of the lower temperature. In the case of chamber *C* the walls and ceiling consist of hard iron castings, closely fitted and sealed at the joints. The metal

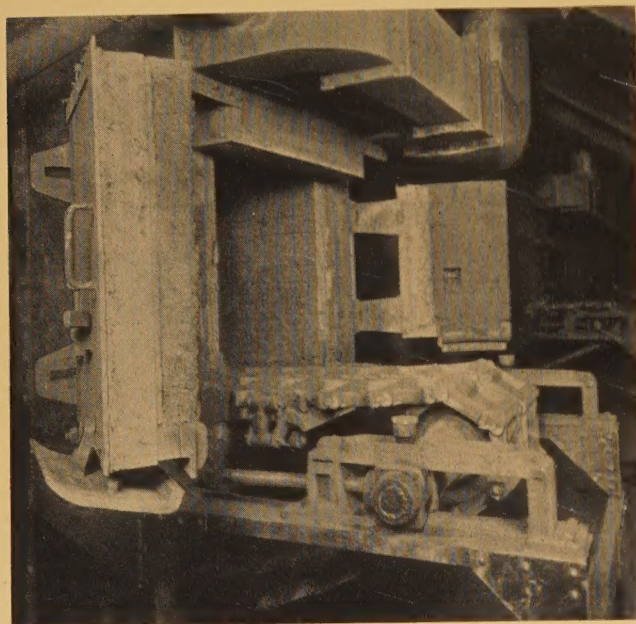


Figure 4. Close view of feed end of clinker cooler shown in Figure 3

used in these castings, known commercially as Cementite, is highly resistant to abrasion.

Air Jacket Around Chambers

Chambers *B* and *C* and a portion of chamber *A* are completely surrounded by an air jacket which is formed by the structural members and metal plates in the outer walls and roof of the cooler. The purpose of this air jacket is that of "capturing" the heat that radiates through the walls and ceiling of the chambers. An air current is drawn through the jacket by the primary air fan, and the heat thus reclaimed is used to raise the temperature of the primary air stream.

Route of the Clinker Stream

Referring again to Figures 1 and 2, the route of the clinker may be followed. As previously stated, the hot clinker drops from the kiln into chamber *A*. From here it is carried along by the drag chains indicated in Figures 1 and 2, and shown also in Figures 3, 4, and 5, passing at the slow rate of about 3 ft. per minute over the fixed grates in chambers *B* and *C*, toward the discharge end of the cooler, where it drops into the clinker discharge spout. This spout is diverted toward one side, so as not to interfere with the return run of the drag chain conveyor.

Thickness of Clinker Bed

The thickness of the clinker bed on the drag chain conveyors may be from 6 to 8 in., depending on the width of the conveyors and the quantity of clinker handled. It is important to have the clinker bed of uniform thickness, in order that the heat absorption may be uniform. This

necessary uniformity of thickness is aided by the action of the swinging gates between chambers, which exert considerable pressure on the slowly moving clinker stream. This action tends to level the stream to a uniform thickness.

While the normal rate of speed of the clinker stream is 3 ft. per minute, as previously stated, the controls for the kiln and cooler motors are synchronized, so that a change in the speed of the kiln produces a corresponding change in the speed of the drag chain conveyor in the cooler.

The Spill Conveyor

An auxiliary part of the cooler consists of a series of hoppers, on 4-ft. centers, beneath the grates in chambers *B* and *C*, placed there as a means of recovering the finer particles of clinker (about 4 per cent of the total) which drop through the grates. The grate bars are shown in Figure 6, approximately half their true size.

The hoppers just mentioned discharge the fine particles of clinker to a small spill conveyor, consisting of a drag chain 5 in. wide and completely inclosed in an air-tight casing that is lined with plates of hard iron.

Route Taken By Air

The air current entering the cooler originates with the main air fan. This fan is connected with a header of rectangular shape and gradually diminishing cross-section, located on one side of the cooler. Individual pipes connect the header with each of the hoppers previously mentioned as being placed beneath the cooling grates of chambers *B* and *C*. These hoppers, therefore, have the double purpose of collecting the fine particles of clinker that drop through the grates and directing the air currents to the grates.

Once passed through the grates and through the overlying bed of hot clinker, the heated air in chamber *C* passes out through the stack, while that in chamber *B* is conducted to the kiln through the insulated hot air flue *J*.

The quantity of air entering chambers *B* and *C* is controlled by dampers in the individual pipe connections be-



Figure 5. Interior view of clinker cooler shows excellent condition after more than a year of service

tween the main header and the hoppers beneath the grates. The quantity admitted to chamber *B*, and conducted from there to the kiln, is just enough to meet the secondary air requirements of combustion. The volume of air admitted to chamber *C* depends entirely on what quantity is required to cool the clinker to the desired temperature. In an installation where the air from chamber *C* is used for some special purpose, such as drying coal, it might be necessary to adjust the volume to meet the special needs of the installation.

The Driving Mechanism

A variable speed motor is used to drive the cooler mechanism where direct current is available. This motor is direct-connected to a speed reducer, supported on the cooler casing at the discharge end. A fabricated roller

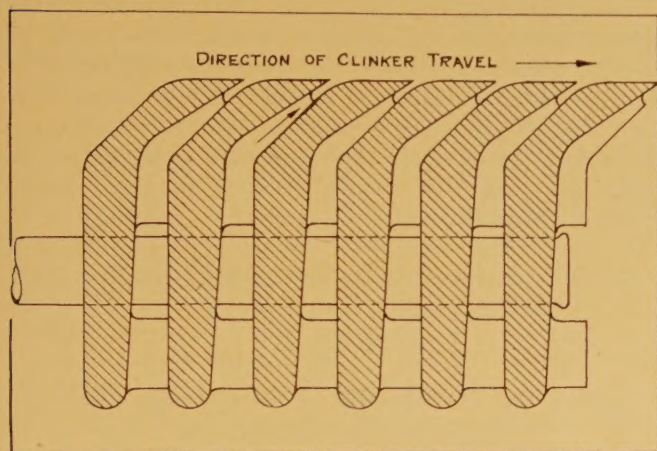


Figure 6. Cross-section of fixed grate in cooler, slightly more than half size

chain, in connection with a set of steel sprockets, transmits the power from the reducer to the head shaft. A similar arrangement of chain and sprockets, originating from the same reducer, drives the small spill conveyor.

The main air fan, which supplies all the air required for cooling the clinker and the gates, is a pressure type, of a special design. It maintains a fairly constant pressure over a wide range of volume changes.

Grindability, Strength and Fineness Improved

The performance of the installations has been highly satisfactory. The rapid cooling of the clinker has had three notable effects, all favorable, on the character of the clinker produced. Essentially, these favorable effects are:

- (1) The grindability of the clinker is improved.
- (2) The quantity of sub-sieve "fines" is increased.
- (3) Higher strength values are attained.

For the purpose of checking the foregoing statements by means of actual tests, comparative tests were made with clinker taken from the new type of coolers, and clinker from rotary coolers. The raw kiln feed was the same in each case. Two compartment mills were used for the tests, one being fed with the rapidly cooled clinker, while the other was fed with clinker from the rotary cooler. The speed, rate of feeding, loading and ball charges were the same in both cases. Samples were taken over a 24-hour period.

Grindability. The rapid cooling of the clinker resulted in structural changes which greatly enhanced its grindability. This result was in conformity with experimental findings. The feature of increased grindability, characteristic of all clinkers when cooled rapidly with air, may be utilized to advantage in either of two ways. Either an equal degree of fineness may be obtained in less time and with less power consumption per barrel, or a greater degree of fineness may be obtained with the same unit power consumption.

Fineness. The average of all samples from each mill, taken over a 24-hour period, showed the following percentages passing the meshes indicated:

	Per Cent	
	Passing Mesh Indicated	
	200-Mesh	325-Mesh
Rapidly cooled clinker.....	95.7	86.2
Rotary cooled clinker.....	90.5	80.4

Both cements were fractionated and the coefficient of effective fineness was determined for each. The cement from the rapidly cooled clinker indicated a surface area 17 per cent greater than that from the more slowly cooled clinker.

Strength. Both cements were subjected to the standard sand mortar briquette test. The cement from the rapidly cooled clinker showed strengths from 75 to 80 lb. per sq. in. higher than the other cement.

High-Early-Strength Cement

Mention has been made of the fine particles of clinker that drop through the spaces between the grate bars in chambers *B* and *C*, and which are recovered by a small drag-chain spill conveyor.

These particles were carefully examined, from which it was observed that they appeared to be more completely burned than the general run of the clinker. In size, these particles ranged principally from 50-mesh to 16-mesh. Chemical analysis disclosed a much higher percentage of lime than in the average clinker, and calculations for the potential constitution showed a much higher ratio of tricalcium silicate to dicalcium silicate than in the average clinker. The mineral compounds clearly indicated values associated with high early strength. When this fine clinker was mixed with gypsum and ground in laboratory equipment to a fineness of 75 per cent minus 30 microns, and an SO_3 content of $2\frac{1}{4}$ per cent, the sand mortar briquette strength values more than met the specifications for high-early-strength cement.

While the quantity of fine clinker falling through the grate is only about 4 per cent of the total and is therefore too small an amount to be of commercial value, the observed facts suggest that further investigation might be advisable. Apparently some relation exists between the size at which the clinker forms in the kilns and its resultant composition.

Large Saving in Fuel

Previous reference has been made to the fact that the older cooler unit installed at the Peerless plant in Detroit in 1930 resulted in a saving of 12 per cent in kiln fuel. A greater percentage of fuel saving was realized from the more highly developed units in the more recent installa-

tions, though it is believed that some of the saving was due to the installation of new kiln ends, new hoods, and improved methods of coal feeding.

Coolers in Perfect Condition

The perfect condition of the coolers, after more than a year of service, is shown in Figures 3, 4 and 5. Figure 3 is a close view of the feed end of one of the coolers. Observe the return run of the drag chain conveyor, underneath the cooler. Figure 4 is a still closer view of the feed end of the cooler shown in Figure 3, with the end doors swung open. Figure 5 is an interior view of the same cooler, also taken from the feed end, with the end doors swung back and the interior gates (between chambers) raised up. Here the lining of the chambers is seen to be in excellent condition. All these views were taken in December, 1932, after all the coolers had been in service for more than a year.

Unemployment Insurance Will Come, Thinks Lewisohn

Samuel A. Lewisohn, president of the Miami Copper Company, speaking at the annual meeting of the American Management Association in Chicago on February 7, warned business men that unemployment insurance is coming. He urged large employers of labor to take a more active interest in the subject and to aid in shaping the legislation that is sure to come.

Mr. Lewisohn expressed the belief that unemployment insurance, under certain conditions, should prove to be a useful palliative, though not a cure-all.

"If the medicine is not to be worse than the disease," he said, "business men and industrialists must decide just how unemployment insurance is to be administered. It is deplorable that business men, in imitating the ostrich, are abstaining from participation in guiding the legislation or even from devoting any serious thought to it."

The speaker made a distinction between what he called "fair weather unemployment" and "hard times unemployment." He defined the first as being due to seasonal trades and because of the introduction of labor-saving devices. Here he paid his respects to technocracy by referring to "the extravagant claims that the machine has created a permanent pool of unemployment," saying "such forebodings of imaginative statistics will probably prove as sound as Malthus' fears that population will outstrip the food supply of the world."

Longer Period Before Relief

Mr. Lewisohn said there is a real need for providing unemployment relief for long depression periods. He suggested that these reserves be collected and administered by industries, holding that were the state to contribute there would be the danger of an insurance scheme developing as in England. The English plan later turned into a relief scheme out of which grew the dole. He also suggested that the state-administrated pools would serve to preserve dying obsolete industries.

Another point stressed was the need for a longer minimum period—sixty days, for instance—before unemployment relief was given a worker. This would necessitate his

building up a reserve to care for immediate unemployment and would encourage him to try harder to find a new job.

Greater Profit for 1932 Shown by Northwestern Co.

Increased operating profits for the fiscal year ended November 30, 1932, are reported by the Northwestern Portland Cement Co., Grotto, Wash., near Seattle. Profits of \$83,302.29 for 1932 compare with those of \$38,256.16 for 1931.

Current assets, of which \$113,755.45 was cash, totaled \$254,689.78, as against current liabilities of \$11,050.04, or a ratio of 23.05 to 1. The statement for 1931 showed current assets totaling \$251,489.68, of which \$105,029.09 was cash.

During the year, sand and gravel property purchase obligations were paid off out of earnings to the extent of \$11,250, reducing that item from \$21,000 to \$9,750. The company has no funded debt, bank loans or notes payable.

Dividends paid during the calendar year of 1932 on the company's 13,500 shares of cumulative preferred stock totaled \$6 a share. Company's policy has been to pay dividends only as earned.

Dr. W. J. Kerr, chancellor of higher education, Corvallis, Ore., is chairman of the board of directors, and C. T. W. Hollister, Seattle, is president.

Council Sponsors Four Regional Safety Conferences

The following regional safety conferences, sponsored by the National Safety Council, are scheduled for the near future, according to the Cement Section *News Letter*:

April 12-13—11th Annual Midwest Safety Conference, LaSalle Hotel, Chicago. For further details communicate with G. G. Traver, manager, Chicago Safety Council, 130 North Wells Street, Chicago.

April 25-26-27—All Ohio Safety Congress, Columbus, Ohio. For further details, communicate with T. P. Kearns, superintendent, department of safety and hygiene, Ohio Industrial Commission, Columbus, Ohio.

May 9—6th Annual Rock River Valley Safety Conference, Fort Atkinson, Wis. W. D. James, president, James Mfg. Co., Fort Atkinson, Wis.

May 11-12—12th Annual State Conference on Industrial and Public Safety, Hotel Statler, Boston, Mass. For further details, communicate with L. E. MacBrayne, manager, Massachusetts Safety Council, 6 Beacon Street, Boston, Mass.

In addition, the fourth Greater New York safety conference is being held March 1 and 2 at the Pennsylvania Hotel, New York City.

Maryland Plant of North American Recalls 150 Workers

Operations were to be resumed on March 1 at the Security, Md., plant of the North American Cement Corp. Between 150 and 160 workmen were to be recalled.

The company has added a large electric shovel to its equipment.

Study of Binary System $\text{CaO-B}_2\text{O}_3$

Ultimate Aim Is to Determine Effect of Addition of Small Amounts of Boric Oxide to the Calcium Silicates in Portland Cement

By ELMER T. CARLSON

THE study of the system $\text{CaO-B}_2\text{O}_3$ was undertaken by the author as a preliminary to a study of part of the ternary system, $\text{CaO-B}_2\text{O}_3\text{-SiO}_2$, the purpose of the latter being to determine the effect of the addition of small amounts of B_2O_3 to the calcium silicates found in portland cement. It is hoped, however, that the results of the investigation of the binary system, $\text{CaO-B}_2\text{O}_3$, may also prove of interest in connection with the production of glazes and other ceramic materials.

Very little work has been done on the anhydrous calcium borates in recent years, and much of the earlier data is conflicting or inconclusive. The first comprehensive study of the system $\text{CaO-B}_2\text{O}_3$ was made by W. Guertler,¹ who constructed the liquidus diagram through the use of cooling curves. He found maxima at 1,030 deg.,² 1,095 deg., and 1,225 deg., corresponding to the compounds $\text{CaO} \cdot 2\text{B}_2\text{O}_3$, $\text{CaO} \cdot \text{B}_2\text{O}_3$, and $2\text{CaO} \cdot \text{B}_2\text{O}_3$, respectively. Due to the limitations of his apparatus, he was unable to go much beyond the last of these, although he argued from analogy with the system $\text{BaO-B}_2\text{O}_3$ that the compound $3\text{CaO} \cdot \text{B}_2\text{O}_3$ should exist. Due to the excessive super-cooling which occurs in this system, the accuracy of his results is somewhat doubtful.

The four borates mentioned have since been prepared by R. Griveau,³ who also studied their heats of formation. He gives the values of 1,025 deg., 1,100 deg., and 1,215 deg., as the approximate melting points of the compounds $\text{CaO} \cdot 2\text{B}_2\text{O}_3$, $\text{CaO} \cdot \text{B}_2\text{O}_3$, and $2\text{CaO} \cdot \text{B}_2\text{O}_3$, respectively. Roberts⁴ reported a melting point of 1,304 deg. for $2\text{CaO} \cdot \text{B}_2\text{O}_3$. Optical properties for the metaborate, $\text{CaO} \cdot \text{B}_2\text{O}_3$, are given by A. N. Winchell.⁵

Burgess and Holt⁶ reported that CaO is insoluble in B_2O_3 in small quantities, but if present in larger amounts the mixture fuses to a clear glass. Guertler⁷ found that a fused

mixture of B_2O_3 and a small amount of CaO separated into two liquid layers which were immiscible even at 1,400 deg.

The melting point of pure CaO was placed at 2,572 deg. by Kanolt,⁸ and at 2,849 deg. K. (2,576 deg. C.) by Schumacher.⁹ The melting point of boric oxide is unknown, as this compound has never been obtained in crystalline form.

Because of the absence of optical data for most of the calcium borates, as well as the conflicting nature of the melting-point data, it seemed desirable to make a study of the system $\text{CaO-B}_2\text{O}_3$, tracing the liquidus as far as possible and determining the optical properties of the various phases appearing in the system.

The general plan followed was to prepare mixtures of CaO and B_2O_3 in varying proportions and to determine their melting points by means of heating curves. The phases existing in equilibrium with the melt at the liquidus were identified by petrographic examinations of samples quenched from various temperatures near the liquidus.

Preparation of Mixtures

Calcium carbonate (CaCO_3) and boric acid (H_3BO_3) were used in the preparation of the mixtures. The percentage composition of the calcium carbonate was as follows: Ignition loss, 43.65; SiO_2 , 0.07; R_2O_3 , 0.04; MgO , 0.04; CaO (by difference), 56.20. The boric acid was

⁸ Kanolt, Melting Points of Some Refractory Oxides, *B. S. Bull.*, vol. 10, pp. 295-313, 1914.

⁹ Schumacher, Melting Points of Barium, Strontium, and Calcium Oxides, *J. Am. Chem. Soc.*, vol. 48, pp. 396-405, 1926.

Abstracted from U. S. Bureau of Standards Journal of Research, December, 1932.

¹ Guertler, On the Melting Points of Mixtures of the Alkaline Earths with Boric Anhydride, *Z. anorg. Chem.*, vol. 40, pp. 337-354, 1904.

² All temperatures given in deg. C. unless otherwise stated.

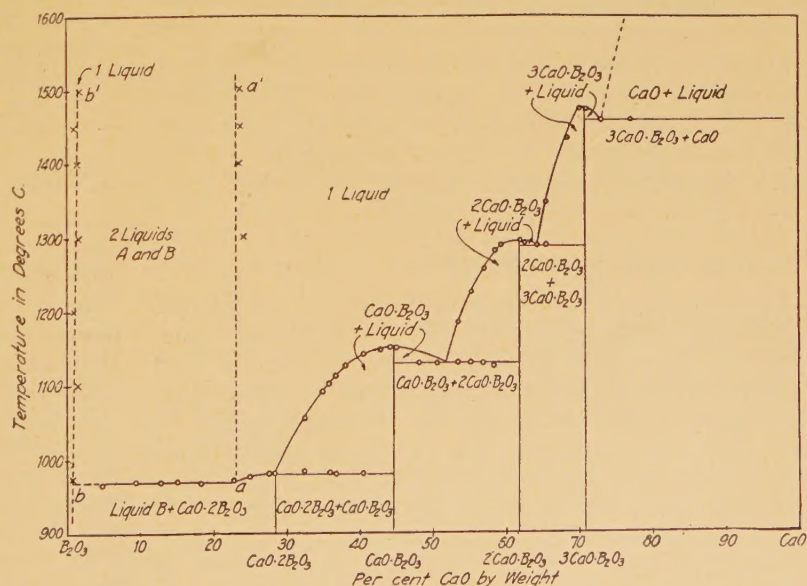
³ Griveau, Heats of Formation of the Anhydrous Calcium Borates, *Compt. rend.*, vol. 166, pp. 993-995, 1918.

⁴ Roberts, Some New Standard Melting Points at High Temperatures, *Phys. Rev.*, vol. 23, pp. 386-395, 1924.

⁵ A. N. Winchell, The Optic and Microscopic Characters of Artificial Minerals. Univ. of Wisconsin Studies in Science, 1924.

⁶ Burgess and Holt, The Behavior of Metallic Oxides Toward Fused Boric Anhydride, *Proc. Chem. Soc.*, vol. 19, pp. 221-222, 1903.

⁷ Guertler, On the Limits of Miscibility of Boric Anhydride and Borates in the Fused State, *Z. anorg. Chem.*, vol. 40, pp. 225-53, 1904.



Phase equilibrium diagram for the system $\text{CaO-B}_2\text{O}_3$

analyzed only for impurities (analysis by chemistry division of this bureau), which were reported as follows: Fe, <0.001 per cent; SO_3 , <0.01 per cent; Cl, <0.001 per cent. This material was recrystallized in order to render it finer, as it was difficult to pulverize the flakes by grinding. For each mixture the calculated amount of calcium carbonate was first calcined and then thoroughly mixed with the required quantity of boric acid and heated over a burner (Meker type). The materials combined readily to form a mixture sufficiently homogeneous for the purpose for which it was intended. The product varied in appearance from a glass to a soft clinker, depending on the composition. In some instances a test for free lime was made by the ammonium acetate titration method,¹⁰ but no free lime was found except in one mixture containing CaO in excess of $3\text{CaO}\cdot\text{B}_2\text{O}_3$.

Results of Experiments

Four binary compounds were found in the system. These were $\text{CaO}\cdot 2\text{B}_2\text{O}_3$, $\text{CaO}\cdot\text{B}_2\text{O}_3$, $2\text{CaO}\cdot\text{B}_2\text{O}_3$, and $3\text{CaO}\cdot\text{B}_2\text{O}_3$, described in the four paragraphs that follow.

Calcium diborate, or calcium tetraborate, $\text{CaO}\cdot 2\text{B}_2\text{O}_3$ —This compound occurred as the primary phase in all the mixtures containing up to about 23 per cent CaO. As ordinarily prepared it remained in the form of a glass; but by heating for a few minutes at a temperature slightly below the melting point, this could be devitrified readily. It appears as irregular grains, highly birefringent, uniaxial, negative; $\omega = 1.638$, $\epsilon = 1.568$. Whether or not it melts congruently could not be determined with certainty, as its composition apparently lies at the break in the liquidus. The melting point is $986^\circ \pm 5^\circ$.

Monocalcium borate or calcium metaborate, $\text{CaO}\cdot\text{B}_2\text{O}_3$ —This compound occurs as the primary phase in mixtures containing approximately 29 to 51 per cent CaO. It appears as long, flat plates, highly birefringent, biaxial, negative, with a large optic axial angle; $\alpha = 1.550$, $\beta = 1.660$, $\gamma = 1.680$. It melts congruently at $1,154^\circ \pm 5^\circ$.

Dicalcium borate or calcium pyroborate, $2\text{CaO}\cdot\text{B}_2\text{O}_3$ —This compound occurs as the primary phase in mixtures containing approximately 51 to 64 per cent CaO. It appears as irregular grains, highly birefringent, biaxial, negative, with small optic axial angle; $\alpha = 1.585$, $\beta = 1.662$, $\gamma = 1.667$. It melts at $1,298^\circ \pm 5^\circ$.

Tricalcium borate or calcium orthoborate, $3\text{CaO}\cdot\text{B}_2\text{O}_3$ —This compound occurs as the primary phase in mixtures containing from 64 to at least 71 per cent CaO, and probably somewhat higher. It appears as irregular grains, highly birefringent, uniaxial, negative; $\omega = 1.728$, $\epsilon = 1.630$. It melts at $1,479^\circ \pm 5^\circ$.

The Phase Equilibrium Diagram

The phase equilibrium diagram is shown in the figure. Mixtures containing less than 24 per cent CaO were found to separate into two immiscible liquids (which for convenience may be designated as *A* and *B*) on fusion. The heavier of the two liquids (*A*) on cooling formed a clear glass with a refractive index of about 1.56. It was nearly insoluble in water but soluble in hydrochloric acid. The other liquid (*B*) formed a cloudy glass, which was seen under the microscope to be full of minute globules,

presumably of the other glass. These appeared to separate during cooling, since in quenched samples both glasses were clear. The index of the lighter glass was about 1.45. It was soluble in water, thus affording a simple method of separating it from the other glass for analysis. The water-soluble glass was found to be practically pure B_2O_3 , while the other contained about 23 per cent CaO.

Summary

The phase equilibrium diagram for the system $\text{CaO}\cdot\text{B}_2\text{O}_3$ has been partially worked out. A region of liquid immiscibility was found, extending from 0.2 to 23 per cent CaO, and from 971 deg to above 1,500 deg. C. The optical properties of the four compounds in this system were determined. The melting points of these compounds are given in the table, together with the melting points determined by previous investigators.

MELTING POINT OF THE CALCIUM BORATES

Compound	Melting point, determined by—			
	Guertler (1904) °C.	Griveau (1918) °C.	Roberts (1924) °C.	Carlson °C.
$\text{CaO}\cdot 2\text{B}_2\text{O}_3$	1,030	ca. 1,025		986±5
$\text{CaO}\cdot\text{B}_2\text{O}_3$	1,095	ca. 1,100		1,154±5
$2\text{CaO}\cdot\text{B}_2\text{O}_3$	1,225	ca. 1,215	1,304±5	1,298±5
$3\text{CaO}\cdot\text{B}_2\text{O}_3$				1,479±5

Petoskey Plans for Longer Run in 1933

The Petoskey Portland Cement Co., and its allied firm, Petoskey Transportation Co., at Petoskey, Mich., anticipate a better season this year than last, according to local reports. The plant has been completely overhauled and is to be reopened in April.

J. B. John was renamed head of the two firms at the annual stockholders' meeting on January 28. John L. A. Galster was renamed treasurer and general manager.

Kansas Plant of Lone Star Resumes Operations

The Lone Star Cement Co. (Kansas) plant, near Bonner Springs, resumed operations on February 1, after a shutdown since December 1.

About one hundred men, enough to run the plant at one-third capacity, were re-employed.

New Books and Pamphlets

Conducting Safety Contests

METHODS OF ORGANIZING AND CONDUCTING INDUSTRIAL SAFETY CONTESTS is the title of a 20-page illustrated publication issued by the Metropolitan Life Insurance Co., 1 Madison Avenue, New York.

The development of safety contests, which appeal to the spirit of rivalry, has been found an effective means of encouraging employee interest in safe practices. This publication just mentioned describes in detail the plans used by a number of organizations. It discusses many phases of the subject, from drafting the rules to awarding trophies, and concludes with a brief presentation of the advantages that may be derived from the use of contests to stimulate conscious effort and keep interest alive.

¹⁰ Lerch and Bogue, Revised Procedure for the Determination of Uncombined Lime in Portland Cement, *Ind. Eng. Chem., Anal. ed.*, vol. 2, pp. 296-298, 1930.

EDITORIAL

Shaping Legislation on Unemployment Reserves

THE most effective way to combat objectionable proposals in legislation designed to inaugurate a program of unemployment insurance is to offer sound alternative proposals which will command respect and support.

The foregoing represents the attitude being taken by the National Industrial Conference Board, which has proposed a program of unemployment reserves for American industry.

The conference board offers several impressive reasons why industry should act in this matter. First, it recognizes that industry has a responsibility in relation to unemployment, and that this responsibility involves an obligation to assist its stable and permanent workers in protecting themselves against ordinary periods of unemployment. Second, action taken by industry for the establishment of private unemployment reserve plans will help to reduce the dimensions of the problem of unemployment in general. Third, a program of unemployment reserves that is generally agreed upon by employers will set up a model that will influence the character of legislation on the subject.

If legislation on unemployment insurance is inevitable, as recent developments indicate, industry should have a hand in its preparation. Particularly should employers have the right to establish and operate their own plans.

And again, if industry is to take a hand in this matter, leaders of the cement industry will find it to their advantage to play an important part in the proceedings. Plans that might operate successfully in year-round industries might be utter misfits in the cement industry, with its inevitable seasonal fluctuations. Co-operation with the National Industrial Conference Board may lead to a satisfactory solution.

Paying for Modernization Without Getting It

THE General Electric Company has put forward a great truth in the assertion that when you operate obsolete equipment you pay for modernization without getting it.

In a word, the amount that could be saved by modernizing a plant would soon pay for the cost of modernization. If a plant continues operation with obsolete equipment, that amount is wasted instead of being saved. That is, the plant management is wasting enough money to pay for modernization, but is not getting modernization.

What is more, General Electric is practicing what it preaches. In the last two years it has modernized

its facilities for manufacturing motors at West Lynn, at Schenectady, and at Fort Wayne. It has built a new transformer-tank factory at Pittsfield, and a huge mercury-vapor-steam plant at Schenectady. It has made many other improvements of lesser magnitude, but running into large figures in the aggregate.

The issue seems to be clear cut for cement men. In any individual plant the cost of rehabilitating enough capacity to meet this year's output requirements can be compared with the resultant saving.

The question to be decided is whether to continue wasting that potential saving, or whether to convert it into an actual saving through modernization.

The Hi's and Ho's of the Cement Industry

A FAMOUS eclipse of the sun, visible in the ancient Chinese city of Peking, occurred in the year 2154 B. C., on the tenth of October—or what would have been the tenth of October if the Gregorian calendar had been in use then.

Unfortunately for all concerned, the official government astronomers, Hi and Ho, had neglected their duties and had given no advance warning of the event. When the eclipse came upon them between seven and nine o'clock in the morning the people were wholly unprepared for it, and ran about here and there in the utmost consternation. For this offense Hi and Ho were deprived of their offices, their estates were confiscated and they were driven from the kingdom.

The punishment was severe, but perhaps no more severe than that which awaits some executives of cement plants when certain industrial eclipses occur in the course of the next twelve months.

Executives of some plants have authorized no new installations of consequence in the last three years, and thus they have failed to take advantage of the great advances made in the development of cost-reducing equipment and processes. Others have cut down expenses through the dubious practice of dropping the highest grade of technical talent, thereby crippling their plants in this important department.

When the day of reckoning comes, when these mechanically obsolete and technically undermanned plants are almost totally eclipsed by the modernized, low-cost plants, the stockholders may demand an accounting.

Happily, a short period just ahead of us offers one more opportunity for the Hi's and Ho's of the cement industry to make good. Those threatened eclipses can be prevented if this opportunity is accepted and a sincere start is made toward a revamped plant and a restored technical personnel.

Overcoming Difficulties of Burning High-Limed Cement

Proper Selection of Silica Ratio and Iron Modulus of Great Importance — Experiments with Synthetic Raw Mixtures Reported

AT the meeting of the Association of Japanese Portland Cement Engineers, held in Tokio in November, 1932, Mr. Keiichi Akiyama, of Waseda University, read a paper entitled "The Facility of Burning Portland Cement Depends on Its Hydraulic Modulus, Silica Ratio and Iron Modulus," of which the following is an abstract.

Synthetic raw material consisting of pure chemicals of Kahlbaum was well mixed in the proportion of 24 parts SiO_2 , 6 parts Al_2O_3 , 3 parts Fe_2O_3 , 66 parts CaO , and 1 part MgO . The mixture was kneaded with water into small balls, dried, burnt in the electric furnace in platinum vessels and rapidly cooled. The proportions employed produced the following relations between the chemicals:

$$\begin{aligned} \text{Hydraulic modulus} &= \frac{\text{CaO}}{\text{SiO}_2 + \text{R}_2\text{O}_3} = 2.00 \\ \text{Silica ratio} &= \frac{\text{SiO}_2}{\text{Al}_2\text{O}_3} = 2.67 \\ \text{Iron modulus} &= \frac{\text{Al}_2\text{O}_3}{\text{Fe}_2\text{O}_3} = 2.00 \end{aligned}$$

The temperature was kept for 30 minutes at 1,150, 1,250, 1,300, 1,350, 1,450 deg. C. respectively. The burnt product was, after pulverization, tested for free CaO by Lerch and Bogue's method. The result is shown in Figure 1.

The conclusion reached is that although the temperature of perfect sintering is 1,450 deg. C., for the purpose of studying the facility of lime combination, 1,350 deg. C. is suitable.

In another experiment, 30 raw mixtures of different

From *Cement and Cement Manufacture* (London), January, 1933.

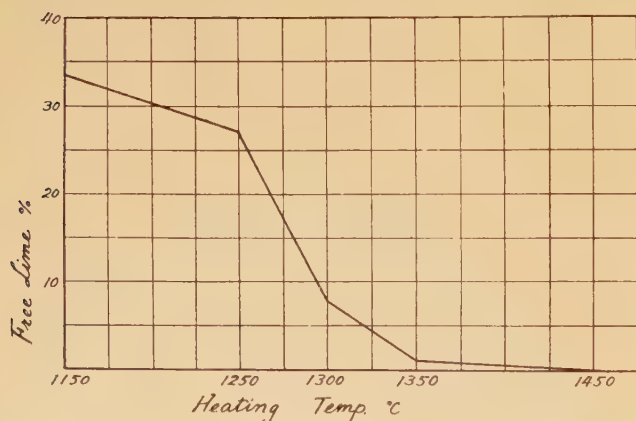


Figure 1. Relation between heating temperature and free lime

proportions were prepared with hydraulic moduli of 2.0 and 2.2, silica ratios of 3.3, 3.0, 2.7, 2.4, and 2.1, and iron moduli of 3.0, 2.0 and 1.5, heated in an electric furnace at 1,350 deg. C. for ten minutes and cooled rapidly. The free CaO contents of the burnt cement are shown in Figure 2, which is self-explanatory. The average of

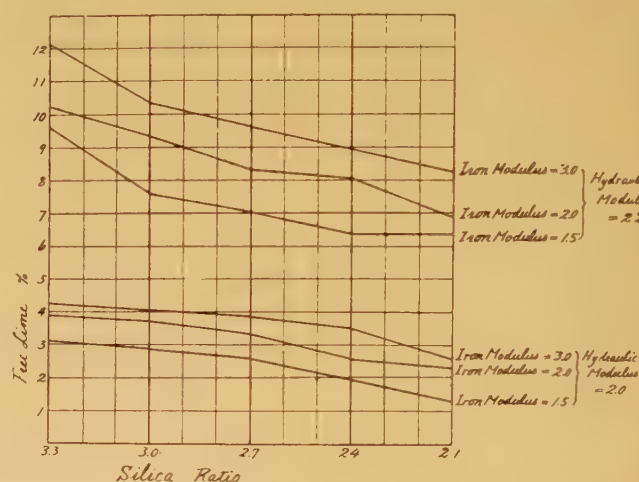


Figure 2. Relation between silica ratio and free lime

free CaO in the upper three lines is nearly three times larger than the lower three, which shows that the burning of high-limed cement is very difficult. On the vertical line

of $\frac{\text{SiO}_2}{\text{Al}_2\text{O}_3} = 3.3$ the average of free CaO content is ap-

proximately 10.7 per cent and 3.8 per cent for hydraulic moduli of 2.2 and 2.0, respectively, whereas free CaO

corresponding to $\frac{\text{SiO}_2}{\text{Al}_2\text{O}_3} = 2.1$ is 7.2 per cent and 2.0 per

cent. The decrease of $\frac{\text{SiO}_2}{\text{Al}_2\text{O}_3}$ facilitates the fusion, the in-

fluence being more marked in the high-limed cement. The

variation of iron modulus $\frac{\text{Al}_2\text{O}_3}{\text{Fe}_2\text{O}_3}$ from 3.0 to 1.5 reduces

the free lime content a little more than 1 per cent in low-limed cement and more than 2 per cent in average in high-limed cement. Therefore the influence of iron modulus on the facility of fusion is more marked the higher the hydraulic modulus.

The conclusion is reached that the proper selection of silica ratio and iron modulus is of great importance in the manufacture of high-limed cement.

Determining Value of Limestones and Other Raw Materials

Different Bases of Valuation for Tax Returns, Bond Issues, Mergers and Common Stock Issues—What Constitutes Value

By EDWIN C. ECKEL
Consulting Geologist, Washington, D. C.

THE question of proper raw material valuation has, during the past decade, come into more and more importance not only to cement companies but to various other industrial groups. That increased importance is due in part, of course, to the fact that such valuations, translated into terms of raw material depletion, become a serious factor in fixing tax returns for both state and federal uses. Raw material valuations appear in another way as an important factor in industrial financing, and that phase of the matter is becoming more prominent during the present world depression, when even soundly based companies find that their security issues, existing or pending, are being scrutinized with more than usual care by bankers, investors and boards of control.

Basis for Sound Valuations

A good many years ago, at a time when unscrupulous promotions were particularly abundant, the matter of cement finance was summarized in a little book which has had the curious fate of having been introduced as evidence on one side or the other of most anti-trust cases since its appearance, and of having been cited frequently in post-office and blue-sky investigations. Today most of the data used in it are of course outdated, and as there seems to be no reason to republish it in complete form, some of the really valuable suggestions it contained may easily be overlooked at a time when they would be of special service. For that reason one particular phase of the valuation matter is here briefly summarized, in the hope that it may serve as the basis for a sound and reasonable policy with regard to such valuations.

At the very outset we should distinguish sharply between valuations made to serve as a safe basis for bond issues, valuations made for common stock issues, and valuations made for purposes of equitable combination.

Valuation for Bond Issues

In the case of valuations for bond issues, it is obvious that both limestones and clays are, in most parts of the United States, so very common that the mere existence of a deposit does not *of itself* give any value to it. To assign any such tonnage value, and to use that valuation as security back of a bond or preferred stock issue, is merely to invite disaster, unless it is clear that the particular raw material deposit under consideration enjoys some special element of monopoly advantage. In that case such advantage, expressed in figures, can of course be safely used and capitalized.

In speaking of a monopoly advantage we must be pre-

pared to include *any* natural or trade condition which confers such advantage. A deposit may have a monopoly value because of its location, being clearly nearer in freight charge to its market than any other good deposit. Or a deposit may have advantages in quality, being (for example) low-magnesia in a magnesian district, or low-silica in a region of generally cherty limestones. A deposit may admittedly have a differential operating advantage, having slight stripping as compared with its nearest competitors, easier grinding stone, or other factors of that type. Any such clear advantage may, in my judgment, be fairly and safely taken into consideration and capitalized in fixing a valuation, for whatever purpose.

It is of course simplest if the differential advantage above considered has been shown by actual past transactions—if, for example, there are records of actual sales in open market of the quarry stone, or of quarry lands, showing that they carry prices or profits in excess of competitive stone or land. But it is not strictly necessary to have such past records, and in the case of a newly opened district, or of an old quarry which is to be turned to new uses, it would be clearly impossible to secure such data. All that has to be taken into consideration and fairly weighed. The main fact to be kept in mind is that there should be some clear reason why a bond owner can count on profits from that particular quarry continuing even in case of receivership. He must be assured, that is, that the quarry will not be merely dropped out.

Where Real Valuations Are Less Important

In the other cases suggested, the valuation is not necessarily so strictly limited, because conditions are obviously different. If, for example, two industrial corporations are considering consolidation, there is no real interest in the actual value of the raw material deposits—the interest is in making sure that the different deposits involved are all valued on the same equitable basis. So in this case the *unit valuation* used may be very conveniently chosen, but the *relative tonnage* estimates made will be matters of far more serious concern.

Finally, in the third possible case, where only common stock issues are involved, the matter takes still another aspect. In by far the majority of cases the valuations both of raw material and plant are in that case admittedly conventional, being designed merely to permit legal issue of stock below par. When sound existing or prospective companies are concerned, there is no particular objection to that well-known practice. But in times of widespread promotional activities, such as we will probably encounter as we emerge from the present depression, there is always

the chance, practically the certainty, that such a purely conventional valuation will be taken seriously by some unfortunate purchaser of the new securities. That is the objection to handling work of that sort except for known established houses; and it suggests one reason for the painfully high percentage of failures and reorganizations among promotions.

Measurement of Sub-Sieve Fineness Occupies A. S. T. M. Meeting

A discussion on industrial applications of particle size measurement, which is intended to comprise a critical analysis of fineness testing for specific industrial groups, is being sponsored by the American Society for Testing Materials in connection with its regional meeting to be held in New York City at the Hotel New Yorker on March 8. Speakers have been obtained to lead the discussion on pigments, abrasives, dusts, soils, cement, and road and concrete aggregates.

The program, which is being arranged by the society's Committee on Fineness Testing, under the chairmanship of Dr. L. T. Work, assistant professor of chemical engineering, Columbia University, will have specific reference to the determination of sub-sieve sizes. The meeting will be called at 9 a. m. and all those interested in this subject are invited to participate.

A symposium on motor lubricants will be the chief technical feature of the regional meeting. Papers in this will be given in two sessions, beginning at 2 and 8 p. m.

Allentown Company Plant Reopens with Full Force

Announcement of the reopening of its plant with a full force was made by the Allentown Portland Cement Co. in January.

The plant is located at Evansville, Berks Co., Pa.

PERSONALS

John L. Senior has been named president of the Trinity Portland Cement Co., succeeding the late W. H. L. McCourtie. Mr. Senior is also president of the Consolidated and Florida Cement companies, and president and general manager of the Signal Mountain Company.

H. G. Nevins has been employed as representative in the Greater Chicago district by the Dewey Portland Cement Co. He will promote the sale of Dewey portland cement, as well as two special products—Super Cement and a masons' cement.

Separating the Ingredients of Commercial Cement-Trass Mixture

Stain Laboratory Develops Procedure Much Simpler Than Method of Chemical Analysis

We know that certain minerals (such as puzzolana and gaize) containing active silica which combines directly with lime, if added to a cement mortar after calcination, confer on concrete the property of being less vulnerable to the attack of sea water or of selenitic water.

The incorporation of these materials has the effect of forming hydrosilicates and hydroaluminates of lime, on which neither sea water nor water carrying selenite in solution has any effect.

The action is the same when adding trass to mortars and concretes, provided it is in a pulverized state, in the form supplied by several cement factories which deliver the cement-trass in premixed form.

Proportions in Commercial Mixtures

In order to permit the consumer to determine the proportions of the two components of the commercial mixture (cement and trass), the Dutch technical journal *De Ingenieur* proposes a method for testing the quantity of each component which seems preferable to the chemical analysis method employed up to the present. This method

is the one developed by the Stain Laboratory at The Hague.

The Laboratory Procedure

The two components—cement and trass—are characterized by their distinctly different specific gravity (trass from 2.36 to 2.59 and cement from 3.10 to 3.25). The mixture is deposited in a liquid such as bromoform, having a specific gravity of 2.83—somewhat heavier than trass but lighter than cement—where it is agitated and centrifugalized.

When centrifugalized in a glass tube, the cement will be seen to settle to the bottom, while the trass floats on the surface. The materials thus separated are weighed. But inasmuch as the trass has the troublesome tendency to become mixed with the bromoform, the tube is frozen, the liquid becoming solidified at 6.5 deg. C. Then, when the surface is slightly and carefully thawed, the frozen mass slides out of the tube. The two materials being thus separated, all that remains is for them to be dissolved in alcohol, filtered, washed, dried and weighed.—Translated from *Le Ciment*, November, 1932.

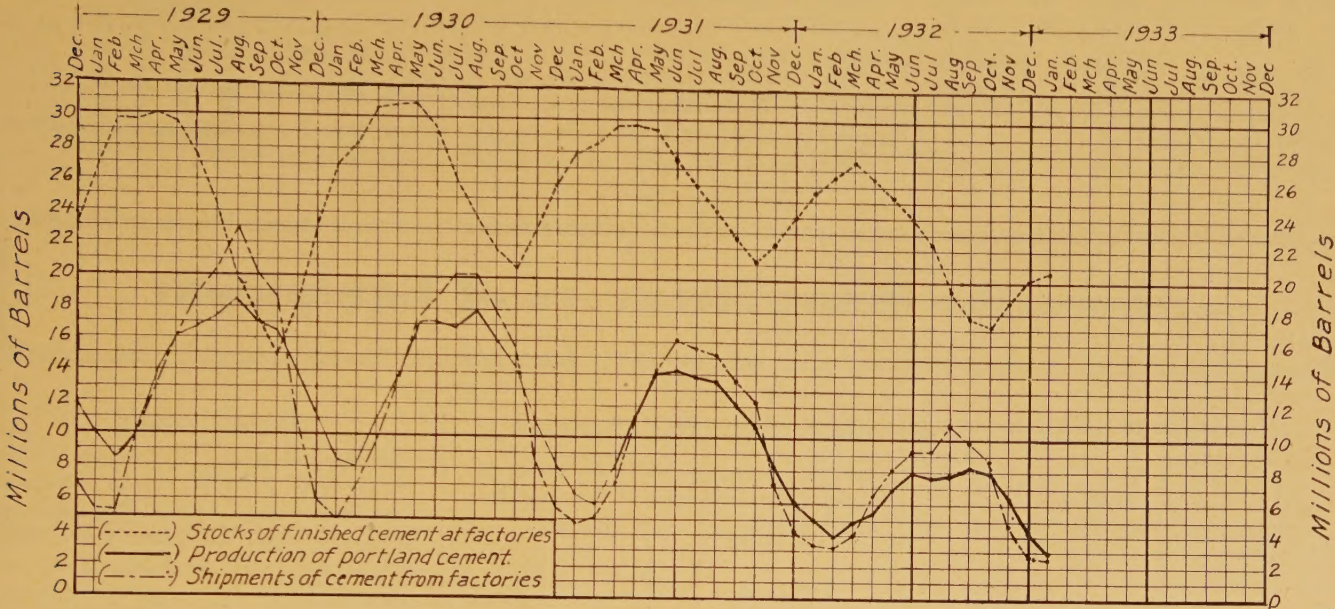
Cement Statistics for January

Relation of Production to Capacity
(Per Cent)

	The Month	Twelve Months
January, 1933	12.9	27.6
January, 1932	22.0	45.9
December, 1932	18.5	28.3
November, 1932	29.1	29.0
October, 1932	34.6	29.6

Production, Shipments and Stocks of Finished
Portland Cement (Barrels)

	1932	1933
Production, January	5,026,000	2,958,000
Shipments, January	3,393,000	2,502,000
Stocks at end of month	25,778,000	20,660,000



MILL EQUIPMENT

New Breaker with New Oil-Filled Bushings Being Made by General Electric

A new line of circuit breakers, rated 15, 25 and 34.5 kilovolts, is announced by the General Electric Co. These breakers are equipped with oil-filled bushings of a new type, which is said to give the same efficient insulation and good service, for potentials up to 34.5 kilovolts, that higher voltage oil-filled bushings have given in the past.

By utilizing the oil-blast principle of circuit interruption, the breakers operate in eight cycles. They are designated Type FHKO-339, designed for indoor and outdoor service, and have interrupting ratings based on 500,000 to 1,500,000 kv.-a.

Breakers are of the round-tank construction (one per pole). The three top domes are welded into a single supporting plate. Mechanism is entirely internal, eliminating any tendency to reclose during or after circuit interruption.

The oil-blast principle of circuit interruption, used in these breakers, involves

forcing oil through a definite channel into the arc path, preventing the arc from re-striking after a current zero.

New Automatic Stoker Announced by Link-Belt Company, Chicago

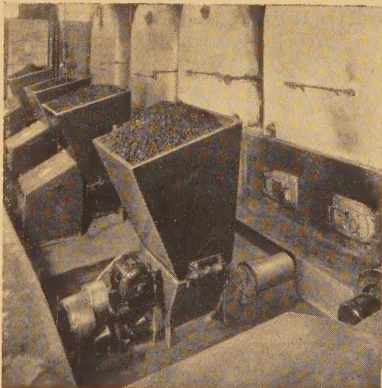
Link-Belt Company, Chicago, announce the Link-Belt automatic underfeed screw stoker. This stoker is at present made in a number of sizes suitable for heating plants and smaller steam plants—boiler capacities from 10 to 250 b.h.p.

It is manufactured in Chicago by Link-Belt Company, and installed and serviced by this company or its authorized distributors.

Some features of design are given as follows:

1. Unique design of motor mounting, permitting direct connection to the forced draft fan, and providing an easily accessible and compact assembly.
2. Variable speed transmission regulating coal feed. Provided with safety shearing pin for overload protection.
3. Chrome steel screw conveyor.

4. Finished castings of heavy grey iron.
5. Automatic Electric controls for operating at previously determined boiler pressures.



Automatic underfeed screw stoker

6. Easy accessibility of all working parts.

The Link-Belt variable speed stoker transmission, of which this stoker is an outgrowth, has been manufactured by this company for some years.

New Performance Records Claimed for Improved Condor Belt

A uniquely designed, interlaced, cord-duck carcass and a through-and-through application of a special rubber compound binding the entire structure of the carcass into an inseparable section give new qualities to the Condor conveyor belt, according to the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J.

The new belt is said to possess unparalleled flexibility, lack of stretch and puncture-proof properties.

In more than five years of testing, these

new type conveyor belts have run up performance records that surpass all previous ones made on the same installations, it is stated.

Manhattan engineers attribute the remarkable performance of this belt to the specially-woven duck which is used in the carcass, together with the effective bonding of the interlaced members. It was stated the bonding compound and the method of impregnating the belt with it are also a new development by that company.

The increased flexibility of the belt is due chiefly to the elimination of the usual hard belt duck. This would not be possible except for the special interlaced cord

duck construction incorporated in the new Condor belt.

Six advantages and exceptional points are claimed for the belt. They are:

1. Extreme flexibility—troughs perfectly even in thick ply and narrow belts.
2. Reduces stretch to a new minimum.
3. Gives longer belt life, due to complete bonding of every member in the belt into a homogeneous structure.
4. Inseparable adhesion between the interlocking plies.
5. Inseparable wear-resisting covers.
6. Resists puncturing by sharp materials to an amazing degree.

About the Manufacturers of Equipment

New B. & W. Division to Handle Cement Mill Business

The creation of a new department to handle all sales of cement mill equipment and composed of men experienced in cement mill operations and pulverizing equipment is announced by the *Babcock & Wilcox Co.*, 85 Liberty street, New York, N. Y.

The organization of this department will include representatives of the company in New York, Atlanta, Chicago and San Francisco who will specialize on pulverizers for coal, raw material and clinker, dryers, feeders, Fuller-Kinyon systems for coal handling, wear resisting castings, and other cement-making equipment under the direction of *E. H. Fromm*, New York, manager of the new department.

H. B. Smith, who will work with Mr. Fromm in the eastern territory, has been employed by the *Babcock & Wilcox Co.* for many years, specializing in waste heat boilers, which work took him into cement plants throughout the country.

J. G. Burke, whose office will be in the Candler building in Atlanta, will represent the new department in the southern territory. Mr. Burke was formerly chief engineer of the *Bradley Pulverizer Co.*, and more recently has been in charge of testing of B. & W. cement mill pulverizers.

H. G. Barnhurst has been appointed the middle west representative at 20 North Wacker Drive, Chicago. He was for many years chief engineer of the *Fuller Engineering Co.*, and later advisory engineer of the *Fuller Lehigh Co.* His most recent activities with the *Babcock & Wilcox Co.* have been in connection with the application of the new B. & W. pulverizers to cement work.

Pacific Coast business of this department will be handled by *G. C. Barnaby*, who has

been the representative of the *Fuller Lehigh Co.* for seven years in San Francisco, with offices in the Sharon building.

Babcock & Wilcox Representative

E. A. Livingstone has been appointed a sales representative of the *Babcock & Wilcox Co.* and the *Babcock & Wilcox Tube Co.*, with headquarters at 85 Liberty Street, New York City.

Share-the-Work Plan in Goodrich Factories

The operation of the winter share-the-work plan in the Akron factories of the *B. F. Goodrich Co.* since October 1 has resulted in the retention or the recall of approximately 500 workers, according to *T. G. Graham*, vice-president.

Joins Snell, Inc.

Dr. J. Mitchell Fain, consulting chemist, is now associated with *Foster D. Snell, Inc.*, 130 Clinton Street, Brooklyn, N. Y.

Industrial Literature

Turbine Applications

Where to use steam turbines for the mechanical drive of pumps, fans, compressors, blowers, pulverizers and stokers is the theme of a new 16-page publication of the *General Electric Co.*, Schenectady, N. Y.

Possibilities in application are described in some detail and shown in a variety of illustrations.

Buyers' Guide

Designed to provide information on rubber goods for industrial uses in convenient form, understandable alike to the engineer, purchasing agent and other plant executives, as well as any general purchaser, the *Diamond Rubber Co., Inc.*, of Akron, Ohio, has just issued its new Buyer's Guide to Mechanical Rubber Goods.

It contains 24 pages on many of the most widely used mechanical rubber products. It also lists standard stock sizes and list prices.

New Vibrating Screen Catalog

Having made numerous improvements in its line of vibrating screens, *Link-Belt Co.*, Philadelphia, has recently completed a new illustrated catalog No. 1362 giving sizes and types of screens available, with dimensions, descriptive matter and installation views. Both unbalanced-pulley drive and heavy duty positive drive type screens are covered.

Electronic Device Abstract

Recent Developments in Electronic Devices for Industrial Control, a paper presented before the recent winter convention of the A. I. E. E., by *F. H. Gulliksen*, is available in mimeographed form.

The author is in the control engineering department of the *Westinghouse Electric and Manufacturing Co.*

Steam Pump Publications

The Worthington Pump and Machinery Corp., whose principal office is located at Harrison, N. J., has issued a list of new catalogs, bulletins, and other types of publications on direct acting steam pumps.